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The 2010 International Cosmos Prize commemorative lecture

Keeping the land alive and well

ESTELLA B. LEOPOLD

There is nothing that could have given me more pleasure than to discover friends on the other side of the Pacific, who share with me a love and respect for nature and the land on which we all live.

I greatly admire the mission of the Expo '90 Foundation: "harmonious coexistence of nature and mankind". It is very much like the key idea in my father's well known book of essays, *A Sand County Almanac*. Aldo Leopold wrote:

When we see land as a community to which we belong, we may begin to use it with love and respect. There is no other way for land to survive the impact of mechanized man, nor for us to reap from it the aesthetic harvest it is capable, under science, of contributing to culture.

He called this a land ethic, which, in his words, "simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively, the land". These are his criteria for a land ethic:

A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise.

My stories today, drawn from my work over the past 40 years, are examples of occasions in which engaged citizens, as a result of their caring for the land, brought about certain actions protecting the land and fostering its capacity for sustained functioning, or what my father called "land health". In each case, citizens not only protected land from being overrun by development but helped nature regain its health in a way fruitful for all species.

Volcanoes: the ring of fire

Volcanoes dominate the landscape in both Japan and the western United States. In the Pacific north west, where I live, they soar up to 4,400 m (14,436 ft) high. Of all the glorious features of Japan, one stands out as a symbol of the nation and takes away the

breath of many of us tourists: your lovely Mount Fuji.

Mount Fuji is a very special stratovolcano, 3,776 m (12,388 ft) in height. It forms a perfect cone shape. The snow-covered peak, the dark Aokigahara forest, and the beautiful lakes around it make Mount Fuji a scenic and vitally important cultural icon.

In western Washington we *had* a volcano that, before 1980, was a close image of Mount Fuji. Mount St Helens, also a stratovolcano, had a height of 2,950 m (9,700 ft), was symmetrical in shape, boasted a snow-covered, cone-like peak and rose out of lakes and dark Douglas fir-forested slopes similar to Mount Fuji's. It too was a majestic and beautiful mountain.

Each of these mountains lies with others in an arc of volcanoes along the "rim" of the Pacific. Some 18 volcanoes dot the west coast of America. Japan's comparable 25 volcanoes also lie along this volcanic arc. It is as though a "ring of fire" joins our two countries together in a common environment.

Historically, both of these mountains have been revered by the local people. Mount Fuji is noted in ancient Japanese literature and is the subject of many poems and works of art, and Mount St Helens was known as "the Fuji of America" because its symmetrical beauty was similar to that of your Fuji-san. But on May 18, 1980, the graceful cone of Mount St Helens, with its glistening cap of perennial snow and ice, was transformed in a few hours into the extensive volcanic ash that blanketed much of the north western United States. The hot blast (up to 800 °C) flattened timber like matchsticks and great mudflows filled the valleys. We were left suddenly with a huge barren landscape bare of plant and animal life. Areas of pyroclastic flow were left with no vegetation at all and trees were flattened or buried over an area of 60,000 hectares (230 square miles).

Government agencies at every level started out by treating this as a catastrophe that had to be fixed somehow and the land returned to its previous condition. Forestry agencies and lumber companies wanted to plant small conifers everywhere. The US Soil Conservation Service wanted to broadcast non-native grass seed from the air. Fisheries agencies called for the reintroduction of "useful" fish. In contrast, a dedicated conservation group and a number of scientists at the University of Washington-based Quaternary Research Center, where I was director at the time, realized that the eruption of Mount St Helens offered a great opportunity to set aside a large tract of land for a grand experiment. What if we, as scientists, were to document just how the ecosystem would recover? What might that teach us about the Earth's natural healing processes? What would it mean for the public to admire an incredibly dynamic ecosystem and learn how life returns naturally to an immense devastated area? We scientists at the university could well imagine what a great national monument this could become.

In the event, five of us scientists and seven other conservationists flew to

Washington DC to testify to Congress to this effect, and Congress eventually passed a bill to establish a Mount St Helens National Volcanic Monument with the help of senators from our state. The US Geological Survey drew a map for the monument boundaries encompassing 44,515 hectares (110,000 acres). According to the new law, the core of the devastated area — the land incorporated in the national monument — is reserved for research. Rules state that access is permitted only on designated foot trails; elsewhere, no human disturbance is allowed.

The result has been a natural laboratory without equal, making this the most thoroughly studied large forest disturbance area in the world. Scientists have examined it from every angle and on every scale, “from molecule to ecosystems, from bacteria to mammals,” in the words of one of them. The first forms of life on the hot moonscape of the volcano were tiny spiders, carried aloft by web fragments acting as parachutes. Few of these airborne arachnids survived but their contributions were critical: dropping in at the rate of 2 million spiders per day, they represented tons of crunchy titbits, ready for the picking. What came a-picking were beetles of the genus *Bembidion*, hundreds of different species of them, including scavengers and predators that thrive in fresh devastation.

The plants came in more slowly on the blast zone but, in the downed timber, the slopes turned red with fireweed (*Epilobium*) within a year. Also within a year, shrubs such as willows and alders came up from roots buried in the ash. The rodents and then the deer and elk returned. Thank heavens for the blast as it killed off all the exotic fishes in the area! That may not seem important but if you are a minnow, a tadpole or a dragonfly larva, it means a chance at life. The blast removed a number of invasive species and created a habitat where native species could once again thrive. Native wildflowers have made an impressive comeback and there are practically no weeds, except along the edges of the foot trails.

Today Mount St Helens is a beautiful example of natural succession, showing how a barren landscape is recolonized by completely natural means. Protection of the national monument by the US Forest Service has allowed nature to flourish in a natural way, without human intervention. The new national monument is today one of the most highly visited sites in our region of the country, with more than 500,000 people from all over the world coming every year. A fine interpretive center is poised on a ridge in front of the gaping crater. Even though this ridge was part of the blast zone, the center is now surrounded by thick stands of native wildflowers and grasses, beautiful to behold. It was the strength of citizen voices — of conservationists and of scientists — that brought this issue to national attention. Leaving nature alone in this case has resulted in a “harmonious relationship” and we now have a fine national monument.

There may be implications in this story for your Fuji-san here in Japan, for Mount

Fuji is also a stratovolcano and, although it is unlikely, someday there could be a major eruption. Your scientists might therefore be interested in seeing what happened in the blast zone on Mount St Helens.

Florissant: the gift of a volcano

In another volcanic setting, as a paleoecologist in Colorado, I have studied the Florissant fossil beds south west of Denver. My special interest is the study of tiny fossil pollen grains, seen here [on page 9] greatly enlarged by a microscope. From the distinctive shapes of the pollen, I am able to identify many of the trees and shrubs from millions of years ago in order to learn about the vegetation of past environments and what it may tell us about climatic conditions and changes over time. In many places, pollen grains are the only fossils that survive.

The fossil beds at Florissant were incredible, with whole plants and animals preserved in volcanic ash, the result of eruptions that occurred 34 million years ago. The Florissant fossils preserved the last phase of tropical and subtropical vegetation in the central Rocky Mountains. The primary forest types were redwoods and hardwoods that do not grow in Colorado any more but do occur in eastern China and Japan. Many plants that existed in the US 15 million years ago now grow only in East Asia, for example in Hakusan National Park at 36° north latitude in the hills of central Japan. These include wonderful woody plants such as *Eucommia* (Tochu), *Podocarpus macrophyllus* (Inu-maki), *Koelreuteria* (Mokugenji zoku), *Ginkgo* (Ginkyo) and *Platycarya strobilacea* (Nogurumi).

The geography of the area has changed little since the end of Florissant time 34 million years ago, although the climate then was summer-wet and now it is very summer-dry. To paleontologists, the Florissant fossil beds were world famous but few ordinary citizens knew of them because they were located on private ranches. Then, in the early 1960s, the US National Park Service announced that it was considering the establishment of a national monument at the site. Real-estate prices began to rise as developers bought up desirable land for house sites nearby the proposed natural attraction. The threat to the site from summer homes escalated over the next few years, while citizens — myself among them — tried to draw attention to the need to protect the fossil beds. An ecologist colleague, Bettie Willard, and I began leading field trips to acquaint journalists, members of outdoor clubs and others with the site.

In 1965, we joined with other conservationists to organize an umbrella group of environmental organizations that we called the Colorado Open Space Council (COSC) in order to share research and gain broader support for issues such as the fight to save the Florissant fossil beds. Each conservation organization would select a representative to sit on the COSC board. The work of analyzing issues was done by citizen research



Living the land ethic: the shack in summer
Source: Aldo Leopold Foundation Archives, Baraboo, Wisconsin



Two much-loved mountains: Mount Fuji, Japan (top); Mount St Helens, Washington, USA
Source (below): USGS/Cascades Volcano Observatory



Harebells on the slopes of Mount St Helens
Source: USGS/Cascades Volcano Observatory



Entrance to the Mount St Helens National Volcanic Monument
Source: USGS/Cascades Volcano Observatory



Fossils from Florissant (left to right): pollen grains, including fern spores, conifer pollen and flowering plant pollen; plants and fish; beetles (*Coleoptera*)

Sources (left to right): photo plate by Estella Leopold (1969) in R. Tschudy and R. Scott (eds.) *Aspects of Palynology*, New York: Wiley-Interscience; National Geographic; drawings by J. Henry Blake, US Geological Survey Monography XXI by Samuel Scudder

Keeping the land alive and well



The shack circa 1936 (top) and today

Sources: A. Carl Leopold; 2000 Archives, Aldo Leopold Foundation



View from the shack gate circa 1940 (top) and 2000

Sources: A. Carl Leopold; 2000 Archives, Aldo Leopold Foundation

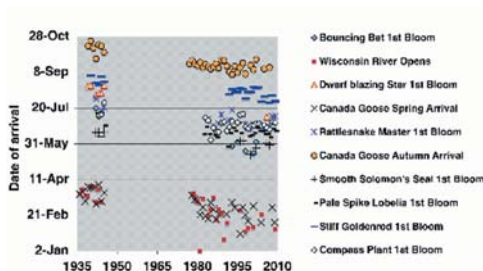


The Leopold farm in 1935 (top); native prairie recovery

Sources: A Carl Leopold; 2000 Archives, Aldo Leopold Foundation



An ongoing legacy: (top line) books about Aldo Leopold and his land ethic; (second line) *A Sand County Almanac* (Oxford Press, 1949), published in translation and as an illustrated volume with photographs by Michael Sewell



Top 10 responders in phenology at the Leopold Preserve, Wisconsin, USA

Source: David Weinstein, Cornell University, Ithaca NY 2010, using data from the phenology database, Aldo Leopold Foundation



The Leopold Center, Aldo Leopold Foundation, Baraboo, Wisconsin USA

Source: Aldo Leopold Foundation (www.aldoleopold.org/legacycenter)

groups called workshops, which would draft a position paper on a particular issue and bring it to the COSC board for discussion, after which each member organization would vote on whether to support that issue.

It was really the breadth and strength of this COSC organization that helped us get attention for the Florissant cause from the national media and bring it before Congress. Eventually, a US senator from Colorado came to visit Florissant and was struck by the beauty of the valley and the abundance of exquisite plant and insect fossils. He managed to get a bill passed by the Senate. But the House of Representatives did not consider fossils an important matter. The bill lay stalled in Congress, just as the threat from real-estate developers intensified.

A small group of scientists banded together to form yet another organization, Defenders of Florissant, in order to hire an attorney to seek a restraining order in the federal court against a developer who was ready to send bulldozers into the fossil beds. This was in the summer of 1969, before the US Congress passed the National Environmental Policy Act that would thereafter require Environmental Impact Statements and provide a better legal basis for challenging actions destructive of the environment. We were fortunate in finding a charismatic young lawyer from New York, who was willing to try to help us. In court, our lawyer held up a fossil palm leaf and said: "Your Honor, to build summer homes on fossils like these is like using the Rosetta Stone to grind corn!"

After four court hearings, we finally won a temporary restraining order. It was one of the first victories in an explicitly environmental lawsuit in our nation's history. The restraining order finally spurred Congress to action and, several weeks later, President Nixon signed the bill establishing the Florissant Fossil Beds National Monument. It had required a seven-year fight to protect fossils that were 34 million years old. It seemed like it took forever but in geological time it was nothing.

Here again it was the strength of the citizen action that made the difference. The citizens were on the right path: several mothers with children even went to Florissant to lie down in front of the bulldozers in case they tried to enter the fossil beds! It was unethical to allow commercial developments to disturb these elegant fossils, and it was right that this natural resource should remain available to the general public for educational, aesthetic and science purposes. National parks and monuments, wilderness areas and other public lands are a critical resource for the education of our youth, a place to study natural ecosystems and open space for public outdoor recreation.

At Florissant today we can stand in the graveyard of a great fallen community, the Florissant ecosystem of the Eocene epoch. Here, with the wonder of a child, we can take the mental journey back through the geological ages. Since Florissant time, for example, the horse has evolved from a small, dog-sized creature that ate woody plants to the large horse of today that grazes only on grasses. The climate has moved from

very warm temperate and subtropical summer-wet conditions to today's summer-dry mountain climate. Standing among the Sequoia fossil stumps in Florissant gives us the perspective of time and evolution. By touching these stones, we can imagine our own version of dynamic life and feel the pulse of the restless Earth.

These are stories about what people have done voluntarily in their role as citizens to care for the land by protecting it and allowing life's evolutionary processes to reveal themselves in the shadow of the force of nature represented by a volcanic eruption. At Mount St Helens, citizens nurtured land health by giving nature the chance to recuperate in natural ways to become a healthy system, capable of sustained functioning, which it is today, 30 years later. At Florissant, citizens showed love and respect for an ancient ecosystem — beautiful fossils preserved in volcanic ash. Part of achieving a harmonious relationship with nature is understanding and respecting the great age of the Earth and appreciating that we are fellow voyagers in a grand sweep of time.

Ecological restoration: the care of the Earth

The setting aside of land, as has been done at Mount St Helens and Florissant, is critical but that alone is not enough to cope with the environmental problems we now face, such as global climate change. We need to foster the conditions necessary for ecosystem health outside of nature reserves as well as within them, on working lands as well as recreational areas, and in our cities as well as rural lands. We need to nurture our children's ability to enjoy and respect nature. We need to look beyond the ground in front of us, to consider also the air we breathe, the water we drink and the oceans that are the support of so much of life on Earth. At this critical time of global change, we need especially to consider the effects of our actions on further climate change and its consequences, for all of nature and humankind.

Most important, our young people need to be able to experience what is involved in taking care of land, public or private, even yards and gardens. Patricia Klindienst's wonderful book, *The Earth Knows My Name* (Beacon Press, 2006), recounts how people who came to the New World from various ethnic backgrounds brought with them their traditional customs on creating gardens that fed their kitchens. This, in turn, enriched and perpetuated their culture and helped them heal the land as well. For them, the garden includes grassy paths and a great web of relationships among the wild and the cultivated, all on an equal footing. The garden can be a way of life, as I know from my own family's gardens over the years. The activity of caring for a garden provides a cultural analogue to the practice of husbandry or stewardship encouraged by my father — that which he came to call a land ethic. As Frances Hodgson Burnett wrote in *The Secret Garden* (1911): "If you look the right way, you can see that the whole world is a

garden.”

Allied with the land-ethic concept, a multitude of conservation rescue efforts are now under way across the US — and around the world — that are bringing back one species at a time to reconstitute certain native ecological vegetation types. Our landscapes have become fragmented and some species are lost altogether. Our efforts to rescue (and recreate) some of these plant and animal associations through ecological restoration — itself a kind of gardening — is now a popular scientific and practical activity on the land. Perhaps the first scientific ecological restoration in the United States was carried out in the 1930s by my father and his colleagues and students at the University of Wisconsin Arboretum. They wanted to try something different to developing a collection of trees and flowers from all over the world, as was the custom in most arboreta at the time. Working on former farmland now within the city of Madison, they set out to reconstruct examples of the various natural ecological communities that were characteristic of southern Wisconsin before European settlement, such as prairie, oak savanna, marsh, fen, deciduous woods and conifer forest.

It was probably the excitement and satisfaction of this new endeavor that led my father to find a place of his own to continue experimenting with ecological restoration. He found an abandoned farm along the Wisconsin River north of Madison, where the soil had been worn out from growing too much corn. It came with a derelict chicken coop that could be refashioned into a weekend shelter for the family. I was only eight years old when he bought the place we came to call “the shack”, so I was able to join my parents — and any of my four older siblings who were still at home or revisiting Madison — for 13 years of wonderful weekends, until 1948, when my father died and I graduated from the University of Wisconsin. At the shack we worked together as a family. We found remnants of native prairie species growing on old railroad rights of way, on grassy road edges where the highway had not obliterated them or, sometimes, on house-construction sites where the native plants were being destroyed. We carried chunks of prairie sod to our old cornfield with its exhausted soil and weeds. Father’s intention was to bring back real tall-grass prairie to that old cornfield. Around the prairie edges and in the woods we planted thousands of pine seedlings and various other species of trees, shrubs and wildflowers, all using native stock, of course.

We began this effort in the mid-1930s when severe drought and dust storms were afflicting the mid-continent. We planted thousands of tree seedlings every spring and cared for them all summer, bringing them pails of water and measuring their height. But still, most of the little trees succumbed to the drought or to rabbits, weevils or other scourges. The first few years were really tough — we lost 95 to 99 percent of the seedlings we planted each year. The view from our gate was really desolate in the early years but we kept planting and, finally, we had some years of better weather when the trees began to grow. Today, years later, we have a fine stand of healthy pines.

In recent years, the pines have needed thinning so we used some of them to build our new Leopold Center a kilometer up the road from the shack.

To keep the woody plants from invading our new grasslands, we would burn the prairies, which can continue as grasslands only if they receive periodic burning. Our old cornfield went from near total exhaustion, with very low nitrogen levels, to the healthy prairie we have today. Nitrogen levels jumped more than 200 percent in just 10 years in the 1990s and the soil is now alive with a hidden metropolis of fungi, worms, bacteria and other microbes. The prairie plants add organic content to the soil, paying back the other soil life with sugars for energy and other organic carbon. It is a complex and unbeatably efficient arrangement — one that works without intervention, except for occasional controlled burning to replace the former wildfires. A rich variety of birds and other animals uses this prairie and these woods for food and cover. We now have healthy ecosystems at the shack.

Ecological restoration is a lot of work but it is fulfilling. As Courtney White, a friend and a dedicated conservationist, who works hard to promote good ranch management practices in the south west, says: “The restoration of health — to creeks, grasslands, ourselves — is a *moral* exercise.” My father’s efforts, first with the University of Wisconsin Arboretum, then later with his farm, came very early in the American conservation movement. Since that time, organizations like our own Leopold Foundation in Wisconsin have been helping farmers and other landowners with conservation on their own lands. We have varied programs to restore prairie, to improve ecological conditions in woods and wetlands, and to develop habitat for various types of birds. We have established a “Woodland School” to train farmers in these restoration efforts. Members of our staff have published books entitled *My Healthy Woods* for three different states with photographs explaining the best methods for improving the health of woodlands and forests with native tree species, using techniques such as selective thinning, fighting invasive weeds and occasional prescribed burning.

Many of America’s small farmers are devoted land stewards but they struggle in a rural economy increasingly organized around large agribusinesses, especially in these years of economic recession. To encourage stewardship of farmland in Washington state, where I now live, a number of conservationists — myself among them — have joined with farmers to start a group called Farming and the Environment to recognize and support farmers who treat their land with care and respect. Each year for six years, we have called for nominations of what we call Stewardship Farmers. We visit the nominated farms during the summer and decide on three stewardship farms to be honored at a dinner each fall. A video of the top farm is shown at the dinner and a cash prize is given. Winners of the Farming and the Environment Award in recent years include Wade Troutman, a farmer in the wheat country of eastern Washington, who

took the prize in 2008, and David Hedlin, a vegetable grower from western Washington, who gained the accolade in 2009.

One of the philosophical leaders of the field of ecological restoration, William Jordan III, says: “At its best, restoration can become an intimate dialogue with an ecosystem. . . Restoration is work and it can also be play, a way of communicating with other species and with the landscape, a mode of discovery and a means of self transformation — a way of both discovering the natural landscape and discovering ourselves in that landscape.” (cited in Courtney White, *Revolution on the Range*, Island Press, 2008).

Restoration can also be considered a form of agriculture in the sense of preparing the soil, controlling weeds, growing plants and harvesting crops. Modern agribusiness seeks to simplify the system, to industrialize it, while restoration seeks to make it more diverse, complex and sustainable over the long term. This is what we mean by land health. A land ethic is a way to guide us to land health. It is a way of maintaining the “coexistence of nature and mankind”.

Phenology: local to global

While restoration immerses the land steward in direct interaction with the land, there are other ways to become intimately involved with the ecosystem. One of them is to carefully observe how it works. From the earliest days on our Wisconsin farm, we all enjoyed keeping track of blooming dates for native plants, migration dates for birds and other seasonal events in nature, year after year.

This study of the timing of biological events throughout the year — of the “pulse of life”, as it were — is called phenology. The cycling of biological events, such as flowering, fruiting, bird migration or animal reproduction, is frequently used to define annual seasonal sequences. Phenological studies have also proved useful in predicting the production stages of certain crops and in measuring the response of plant systems to changes in temperature.

In recent years, the observation of blooming and migration times and the interpretation of such data over the long term has caught on as a real science. Phenology is now an important tool for studying climate change as the response of nature to temperature, rainfall and related climatic phenomena is an increasingly important application of studying nature in the field. In the United States there is now a National Phenology Network that brings together citizen scientists, non-profit groups, government agencies, educators and students to collect and share phenological data from locales nationwide so they can be analyzed for their implications at all scales, local to global.

Long-term records kept by our family at our Wisconsin farm show that many — although not all — species of native plants and migratory birds are now blooming or

arriving earlier in spring than they were in the 1930s. On average, spring events in 2010 occurred 7.6 days earlier compared with 61 years before. The early blooming of our plants seems to correlate with warmer temperatures in March, which, in turn, appear to signify an early ending of winter. Out in Seattle, my records of first blooms of plants also show a general trend to earlier blooming among native species. Most alarming are the data gathered this spring from seven species that were in bloom some 15 days earlier than last year and 10 days earlier than in 1980. Yes, this is an unusual year. But, overall, the data from the plants and animals as well as the instrumental data tell us that the climate is shifting. These studies have led us to increased concern over climate warming.

The records my family has kept over the last 70 years are but a tiny sample compared with records kept here in Japan. Two authors from Osaka Prefecture University, Dr Yasuyuki Anono and Dr Keiko Kazui, have reconstructed several hundred years of data on cherry-tree flowering in Kyoto and used this data on cherry-tree blooms to reconstruct spring temperatures. Their data clearly indicates an increase of 2 °C in March temperatures after 1950 to the present, unlike the last several centuries before 1950. Such Kyoto cherry-tree data confirm that average spring temperatures are warmer now.

From a paleontologist's perspective, the changes in global temperature reflected in these phenological records are occurring much faster than they have in the past 2 million years. That is a worry. As might be expected, the patterns differ for different regions, with warming in the north and cooling in the southern United States, drying in the Great Plains but heavy summer rain in the Mississippi valley. Most troubling is the climatologists' growing evidence that human activity lies at the root of these rapid changes in global temperature.

The land ethic

Each of these stories has shown how citizens — researchers, practitioners and conservation advocates — have tried over the years to understand, protect and restore health to our communities, both natural and human. At Mount St Helens, it was a matter of allowing nature's own resilience to restore ecosystem health in a natural way, while we scientists watched and learned. At Florissant, the volcanic disturbance 34 million years ago had created a wonderful museum of preserved fossils, from which we are now learning much about our past and how to extrapolate to the present and future while having an opportunity to feel our roots and connections to the millennia. In ecological restoration activities at the Leopold farm, at the University of Wisconsin Arboretum in the United States and increasingly worldwide, we are bringing back together the parts (species) and players (processes) that constitute biological diversity

for ecosystems, restoring land health. And in the practice of phenology we are observing components of our local ecosystems more keenly, which also brings us closer to nature. The plants and animals are giving us messages about the climate and, as scientists, we can listen to them. We can listen as citizens, too.

In each of these examples we have seen engaged citizens, inspired by love and respect for the land, who want to do the right thing by nature. These are citizens who have internalized a land ethic. We can see how critical it is on the larger scale for each of us locally to respond to opportunities to protect or restore land health.

The concern about our human impact on the global environment naturally helps us face the mighty question of how we can avoid major detrimental changes as a consequence of our chasing material wealth rather than spiritual satisfaction. Dr Gretchen Daily, last year's recipient of the Cosmos prize, has called for a "new conservation". She feels that "environmentalists aren't really relevant in policy and business decision making". Back in 1940, my father wrote: "Conservation, viewed in its entirety, is the slow and laborious unfolding of a new relationship between people and the land." Too slow an unfolding, Dr Daily might say.

We especially need to create the conditions for such caring relationships with nature for our children. While Japan, with its deep commitment to social harmony, helps point the way — would that we in the US could be more like you! — the Aldo Leopold Foundation in Wisconsin is also doing what it can to foster the land ethic. The foundation's publications include a magazine and handbooks on ecological management of woodlands that have gone out to more than 40,000 people in the last year alone. These reach audiences ranging from the intellectual elite to private landowners who own nearly 6 million acres across the country. Foundation staff, fellows, board members and volunteers regularly give seminars and lectures to general and professional audiences, including the highest levels of government in the United States, Costa Rica and Trinidad. Our efforts have helped encourage scholarship on Aldo Leopold, resulting in three biographies, several collections of Leopold's writing beyond *A Sand County Almanac* and — for me, perhaps, most importantly — the release of a new, beautifully photo-illustrated volume of *A Sand County Almanac* and translations of the original text into 11 other languages. We are also finishing an hour-long film, entitled *Green Fire*, on a land ethic for the 21st century, which will be distributed internationally with subtitles. Finally, with the construction of the Leopold Center in 2007 near Leopold's farm and shack, nearly 30,000 visitors have come from 25 countries to learn more about Leopold's vision and values. The Leopold Center, built of the very trees our family planted and using solar power to produce all the energy it needs on site, exemplifies physically what a land ethic might look like in the 21st century.

The Expo '90 mission to promote the "harmonious coexistence of nature and mankind" is like a land ethic — how very much like it. Embracing that harmony, that

coexistence of nature and mankind, is the only way humanity can survive and flourish. Our quality of life depends on this harmony but we humans seem to have knocked the system out of balance. Each of us must take responsibility in our own small way for nudging humans back into harmony with our natural world. In my case, I hope that, perhaps, stories of citizen engagement, such as I've described, may help us reach for a kind of social harmony that includes a whole community of life. We at the Aldo Leopold Foundation would like to join with you in continuing a conversation about the meanings and implications of "harmonious coexistence" and a land ethic.

I want to thank the International Cosmos Prize Committee and its sponsor, Expo '90, deeply for selecting me for this prestigious award. This prize has already enriched my life. I've seen Japan in a way I never expected. I've seen your Fuji-*san* and I pledge to continue to foster harmonious coexistence with nature. I will purchase a new microscope to look more clearly at the fossil pollen grains that offer so much insight into past environments and climates and the prize will help me and my family, friends and partners at the Aldo Leopold Foundation to foster a land ethic internationally.

Thank you from my heart.

Estella B. Leopold (PhD)

11 October 2010, Shiran Kaikan, Kyoto University